

**INDIANA DEPARTMENT OF TRANSPORTATION
OFFICE OF MATERIALS MANAGEMENT**

**BULK SPECIFIC GRAVITY of AGGREGATE BLENDS
with RECYCLED MATERIALS
ITM No. 584-11T**

1.0 SCOPE.

- 1.1** This test method covers the procedure to determine the bulk specific gravity (Gsb) of a combined aggregate blend with recycled materials used in the HMA mixture.
- 1.2** The values stated in either English or acceptable SI metric units are to be regarded separately as standard, as appropriate for a specification with which this ITM is used. Within the text, SI metric units are shown in parenthesis. The values stated in each system may not be exact equivalents; therefore, each system shall be used independently of the other, without combining values in any way.
- 1.3** This ITM may involve hazardous materials, operations, and equipment and may not address all of the safety problems associated with the use of the test method. The user of the ITM is responsible for establishing appropriate safety and health practices and determining the applicability of regulatory limitations prior to use.

2.0 REFERENCED DOCUMENTS.

2.1 AASHTO Standards.

- R 35 Superpave Volumetric Design for Hot Mix Asphalt
- T 84 Specific Gravity and Absorption of Fine Aggregates
- T 85 Specific Gravity and Absorption of Coarse Aggregate
- T 133 Density of Hydraulic Cement
- T 209 Maximum Specific Gravity of Bituminous Paving Mixtures

2.2 ITM Standards.

- 207 Sampling Stockpiled Aggregates
- 586 Binder Content by Ignition
- 571 Quantitative Extraction of Asphalt and Gradation of Extracted Aggregate from Asphalt Paving Mixture.

2.3 Other References.

- SP-2 Superpave Mix Design by Asphalt Institute

3.0 TERMINOLOGY. Definitions for terms and abbreviations shall be in accordance with the Department's Standard Specifications, Section 101.

4.0 SIGNIFICANCE AND USE.

4.1 This ITM is used to determine the bulk specific gravity of a combined aggregate blend with recycled materials used in HMA mixture.

4.2 The bulk specific gravity (G_{sb}) of a combined aggregate blend is calculated using an estimate of the bulk specific gravity of the aggregate in the recycled materials and the actual bulk specific gravity of the other aggregates.

4.3 The bulk specific gravity of an aggregate blend is used to perform a volumetric analysis on compacted HMA in accordance with AASHTO R 35.

5.0 APPARATUS. The apparatus shall be as stated in the referenced test methods.

6.0 SAMPLING. Sampling shall be as stated in the referenced test methods.

7.0 PROCEDURE.

7.1 Identify the coarse aggregate(s), fine aggregate(s) and recycled materials selected for use in the mix design

7.2 Identify and record the actual percentages for each of the aggregate components used in the combined aggregate blend of the mix design

7.3 Obtain a representative sample of the coarse aggregate, fine aggregate, mineral filler, baghouse fines and recycled materials in accordance with ITM 207

7.4 Determine and record the bulk specific gravity of each of the coarse aggregate(s) in accordance with AASHTO T 85

7.5 Determine and record the bulk specific gravity of each of the fine aggregate(s) in accordance with AASHTO T 84

7.6 Determine and record the bulk specific gravity of each of the mineral filler(s) or baghouse fines in accordance with AASHTO T 133

7.7 Determine and record the maximum specific gravity of the recycled materials in accordance with AASHTO T 209

7.8 Determine and record the asphalt content of the recycled materials in accordance with ITM 571

- 7.9** Calculate and record the effective specific gravity of the recycled aggregate as follows:

$$(G_{se})_{RA} = \frac{100 - Pb}{\frac{100}{G_{mm}} - \frac{Pb}{1.03}}$$

where:

$(G_{se})_{RA}$ = effective specific gravity of the recycled aggregate

Pb = percent binder of the recycled materials

G_{mm} = maximum specific gravity of the recycled materials

- 7.10** Calculate and record the bulk specific gravity of the recycled aggregate as follows:

$$(G_{sb})_{RA} = [0.9397 \times (G_{se})_{RA}] + 0.0795$$

where:

$(G_{sb})_{RA}$ = bulk specific gravity of the recycled aggregates

$(G_{se})_{RA}$ = effective specific gravity of the recycled aggregates

- 7.11** Calculate and record the bulk specific gravity of the combined aggregate blend as follows:

$$(G_{sb})_{TOTAL} = \frac{P_1 + P_2 + \dots + P_N + P_{RM}}{\frac{P_1}{G_1} + \frac{P_2}{G_2} + \dots + \frac{P_N}{G_N} + \frac{P_{RM}}{(G_{sb})_{RA}}}$$

where:

$(G_{sb})_{TOTAL}$ = bulk specific gravity of the combined aggregates blend

P_1, P_2, \dots, P_N = percentages by weight of aggregates 1, 2...N

G_1, G_2, \dots, G_N = bulk specific gravities of aggregates 1, 2...N

P_{RM} = percentage by weight of recycled materials

$(G_{sb})_{RA}$ = bulk specific gravity of recycled aggregates

- 8.0 REPORT.** The G_{sb} of the combined aggregates blend is reported to the nearest 0.001.